

Math 187 –Tutorial on Centroids and MOI

1. Consider the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. We will be calculating the coordinates of the centre-of-mass using the steps below.

a) Sketch the region below.

b) Find dA for a vertical slice.

c) Find (x_e, y_e) in terms of x .

d) Set up (but don't bother to evaluate) an integral to calculate the area A of this region.

e) Set up (but don't bother to evaluate) an integral to calculate \bar{x} .

f) Set up (but don't bother to evaluate) an integral to calculate \bar{y} .

2. Consider the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. (Yes, it's exactly the same region as for question 1, but with different slices.)

a) Sketch the region below.

b) Find dA for a horizontal slice.

c) Find (x_e, y_e) in terms of y .

d) Set up (but don't bother to evaluate) an integral to calculate the area A of this region.

e) Set up (but don't bother to evaluate) an integral to calculate \bar{x} .

f) Set up (but don't bother to evaluate) an integral to calculate \bar{y} .

3. Consider the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. We will be calculating the moment of inertia about the y -axis using the steps below.

a) Sketch the region below.

b) Find dA for a slice that is parallel to the axis of rotation.

c) Find r in terms of the variable you will be integrating with respect to.

d) Set up (but don't bother to evaluate) an integral to calculate the moment of inertia I of this region.

4. Consider the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. We will be calculating the moment of inertia about the x -axis using the steps below.
- Sketch the region below.
 - Find dA for a slice that is parallel to the axis of rotation.
 - Find r in terms of the variable you will be integrating with respect to.
 - Set up (but don't bother to evaluate) an integral to calculate the moment of inertia I of this region.

5. Consider the solid of revolution created by rotating about the y -axis the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. We will be calculating the coordinates of the centre-of-mass using the steps below.

a) Sketch the region below.

b) Find dV for a disk.

c) Find (x_e, y_e) in terms of the variable of integration.

d) Set up (but don't bother to evaluate) an integral to calculate the volume V of this region.

e) One of the coordinates of the centroid is zero. Which one is it and why?

f) Set up (but don't bother to evaluate) an integral to calculate the other (non-zero) coordinate for the centroid of this solid.

6. Consider the solid of revolution created by rotating about the y -axis the region bounded by the curve $y = x^2$ and the lines $x = 0$ and $y = 4$. We will be calculating the moment of inertia about the y -axis using the steps below.

a) Sketch the region below.

b) Find dV for a shell.

c) Find r in terms of the variable you will be integrating with respect to.

d) Set up (but don't bother to evaluate) an integral to calculate the moment of inertia I of this solid.